

The background of the cover is a dark, textured surface, possibly a metallic plate, with a bright, glowing white sphere in the center. From this sphere, numerous thin, white, thread-like lines radiate outwards in all directions, creating a complex, web-like pattern. There are also some smaller, faint, circular patterns scattered across the surface.

# **Representing Electrons**

**A Biographical Approach to Theoretical Entities**

**Theodore Arabatzis**

# Representing Electrons A Biographical Approach To Theoretical Entities

**Theodore Arabatzis**



## **Representing Electrons A Biographical Approach To Theoretical Entities:**

**Representing Electrons** Theodore Arabatzis, 2006 Both a history and a metahistory *Representing Electrons* focuses on the development of various theoretical representations of electrons from the late 1890s to 1925 and the methodological problems associated with writing about unobservable scientific entities Using the electron or rather its representation as a historical actor Theodore Arabatzis illustrates the emergence and gradual consolidation of its representation in physics its career throughout old quantum theory and its appropriation and reinterpretation by chemists As Arabatzis develops this novel biographical approach he portrays scientific representations as partly autonomous agents with lives of their own Furthermore he argues that the considerable variance in the representation of the electron does not undermine its stable identity or existence Raising philosophical issues of contentious debate in the history and philosophy of science namely scientific realism and meaning change Arabatzis addresses the history of the electron across disciplines integrating historical narrative with philosophical analysis in a book that will be a touchstone for historians and philosophers of science and scientists alike

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**Einstein** Thomas Ryckman, 2017-05-18 Albert Einstein 1879 1955 was the most influential physicist of the 20th century Less well known is that fundamental philosophical problems such as concept formation the role of epistemology in developing and explaining the character of physical theories and the debate between positivism and realism played a central role in his thought as a whole Thomas Ryckman shows that already at the beginning of his career at a time when the twin pillars of classical physics Newtonian mechanics and Maxwell's electromagnetism were known to have but limited validity Einstein sought to advance physical theory by positing certain physical principles as secure footholds That philosophy produced his greatest triumph the general theory of relativity and his greatest failure an unwillingness to accept quantum mechanics This book shows that Einstein's philosophy grew from a lifelong aspiration for a unified theoretical representation encompassing all physical phenomena It also considers how Einstein's theories of relativity and criticisms of

quantum theory shaped the course of 20th century philosophy of science Including a chronology glossary chapter summaries and suggestions for further reading Einstein is an ideal introduction to this iconic figure in 20th century science and philosophy It is essential reading for students of philosophy of science and is also suitable for those working in related areas such as physics history of science or intellectual history

**Philosophical Perspectives in Quantum Chemistry** Olimpia Lombardi, Juan Camilo Martínez González, Sebastian Fortin, 2022-05-16 This book explores the philosophy and the foundations of quantum chemistry It features chapters written by experts in the field The contributions analyze quantum chemistry as a discipline in particular its relation with both chemistry and physics from the viewpoint of realism and reduction Coverage includes such topics as quantum chemistry as an in between discipline molecular structure and quantum mechanics quantum chemical models and atoms and molecules in quantum chemistry The interest of this book is twofold First the contributions aim to update and refresh the discussions regarding the foundations of quantum chemistry Second they seek to develop new philosophical perspectives that this discipline can suggest to philosophers of science From its origins quantum chemistry filled a problematic position in the disciplinary space On the one hand it is a branch of theoretical chemistry On the other hand it appeals essentially to theoretical tools coming from physics This peculiar position triggered conceptual questions about its own identity Inside this book readers will find updated discussions on the foundations and the philosophy of this complex discipline

**More Than Nothing** Aaron Sidney Wright, 2024 Across decades and disciplines More than Nothing offers a scoping history of the vacuum as a lens into the development of modern physics

*Quantum Puzzle, The: Critique Of Quantum Theory And Electrodynamics* Barry R Clarke, 2017-04-27 In 1861 James Clerk Maxwell published Part II of his four part series On physical lines of force In it he attempted to construct a vortex model of the magnetic field but after much effort neither he nor other late nineteenth century physicists who followed him managed to produce a workable theory What survived from these attempts were Maxwell's four equations of electrodynamics together with the Lorentz force law formulae that made no attempt to describe an underlying reality but stood only as a mathematical description of the observed phenomena When the quantum of action was introduced by Planck in 1900 the difficulties that had faced Maxwell's generation were still unresolved Since then theories of increasing mathematical complexity have been constructed to attempt to bring the totality of phenomena into order with little success This work examines the problems that had been abandoned long before quantum mechanics was formulated in 1925 and argues that these issues need to be revisited before real progress in the quantum theory of the electromagnetic field can be made

**Essays in the Philosophy of Chemistry** Eric R. Scerri, Grant Andrew Fisher, 2016 The philosophy of chemistry has emerged in recent years as a new and autonomous field within the Anglo American philosophical tradition With the development of this new discipline Eric Scerri and Grant Fisher's *Essays in Philosophy of Chemistry* is a timely and definitive guide to all current thought in this field One of the themes of this collection is how philosophy of chemistry can make a contributions to problems of philosophy more generally such as how

chemistry and quantum chemistry contribute to the philosophy of the mind

**The Story of Western Science** Susan Wise Bauer, 2015-04-27 A riveting road map to the development of modern scientific thought In the tradition of her perennial bestseller *The Well Educated Mind* Susan Wise Bauer delivers an accessible entertaining and illuminating springboard into the scientific education you never had Far too often public discussion of science is carried out by journalists voters and politicians who have received their science secondhand *The Story of Western Science* shows us the joy and importance of reading groundbreaking science writing for ourselves and guides us back to the masterpieces that have changed the way we think about our world our cosmos and ourselves Able to be referenced individually or read together as the narrative of Western scientific development the book's twenty eight succinct chapters lead readers from the first science texts by Hippocrates Plato and Aristotle through twentieth century classics in biology physics and cosmology *The Story of Western Science* illuminates everything from mankind's earliest inquiries to the butterfly effect from the birth of the scientific method to the rise of earth science and the flowering of modern biology Each chapter recommends one or more classic books and provides entertaining accounts of crucial contributions to science vivid sketches of the scientist writers and clear explanations of the mechanics underlying each concept *The Story of Western Science* reveals science to be a dramatic undertaking practiced by some of history's most memorable characters It reminds us that scientific inquiry is a human pursuit an essential often deeply personal sometimes flawed frequently brilliant way of understanding the world *The Story of Western Science* is an entertaining and unique synthesis *Times Higher Education* a fluidly written narrative that celebrates the inexorable force of human curiosity *Wall Street Journal* and a bright informative resource for readers seeking to understand science through the eyes of the men and women who shaped its history *Kirkus* Previously published as *The Story of Science*

*Pursuing the Unity of Science* Harmke Kamminga, Geert Somsen, 2016-05-20 From 1918 to the late 1940s a host of influential scientists and intellectuals in Europe and North America were engaged in a number of far reaching unity of science projects In this period of deep social and political divisions scientists collaborated to unify sciences across disciplinary boundaries and to set up the international scientific community as a model for global political co operation They strove to align scientific and social objectives through rational planning and to promote unified science as the driving force of human civilization and progress This volume explores the unity of science movement providing a synthetic view of its pursuits and placing it in its historical context as a scientific and political force Through a coherent set of original case studies looking at the significance of various projects and strategies of unification the book highlights the great variety of manifestations of this endeavour These range from unifying nuclear physics to the evolutionary synthesis and from the democratization of scientific planning to the utopianism of H G Wells's world state At the same time the collection brings out the substantive links between these different pursuits especially in the form of interconnected networks of unification and the alignment of objectives among them Notably it shows that opposition to fascism using the instrument of unified science

became the most urgent common goal in the 1930s and 1940s In addressing these issues the book makes visible important historical developments showing how scientists participated in and actively helped to create an interwar ideology of unification and bringing to light the cultural and political significance of this enterprise

**The Making of Modern Physics in Colonial India** Somaditya Banerjee,2020-05-14 This monograph offers a cultural history of the development of physics in India during the first half of the twentieth century focusing on Indian physicists Satyendranath Bose 1894 1974 Chandrasekhara Venkata Raman 1888 1970 and Meghnad Saha 1893 1956 The analytical category *bhadralok* physics is introduced to explore how it became possible for a highly successful brand of modern science to develop in a country that was still under colonial domination The term *Bhadralok* refers to the then emerging group of native intelligentsia who were identified by academic pursuits and manners Exploring the forms of life of this social group allows a better understanding of the specific character of Indian modernity that as exemplified by the work of *bhadralok* physicists combined modern science with indigenous knowledge in an original program of scientific research The three scientists achieved the most significant scientific successes in the new revolutionary field of quantum physics with such internationally recognized accomplishments as the Saha ionization equation 1921 the famous Bose Einstein statistics 1924 and the Raman Effect 1928 the latter discovery having led to the first ever Nobel Prize awarded to a scientist from Asia This book analyzes the responses by Indian scientists to the radical concept of the light quantum and their further development of this approach outside the purview of European authorities The outlook of *bhadralok* physicists is characterized here as cosmopolitan nationalism which allows us to analyze how the group pursued modern science in conjunction with and as an instrument of Indian national liberation

*Exploratory Experiments* Friedrich Steinle,2016-09-02 Translated by Alex Levine The nineteenth century was a formative period for electromagnetism and electrodynamics Hans Christian Orsted s groundbreaking discovery of the interaction between electricity and magnetism in 1820 inspired a wave of research led to the science of electrodynamics and resulted in the development of electromagnetic theory Remarkably in response Andre Marie Ampere and Michael Faraday developed two incompatible competing theories Although their approaches and conceptual frameworks were fundamentally different together their work launched a technological revolution laying the foundation for our modern scientific understanding of electricity and one of the most important debates in physics between electrodynamic action at a distance and field theories In this foundational study Friedrich Steinle compares the influential work of Ampere and Faraday to reveal the prominent role of exploratory experimentation in the development of science While this exploratory phase was responsible for decisive conceptual innovations it has yet to be examined in such great detail Focusing on Ampere s and Faraday s research practices reconstructed from previously unknown archival materials including laboratory notes diaries letters and interactions with instrument makers this book considers both the historic and epistemological basis of exploratory experimentation and its importance to scientific development

**The Matrix of Stem Cell Research** Christine Hauskeller,Arne Manzeschke,Anja

Pichl,2019-07-25 Stem cell research has been a problematic endeavour For the past twenty years it has attracted moral controversies in both the public and the professional sphere The research involves not only laboratories clinics and people but ethics industries jurisprudence and markets Today it contributes to the development of new therapies and affects increasingly many social arenas The matrix approach introduced in this book offers a new understanding of this science in its relation to society The contributions are multidisciplinary and intersectional illustrating how agency and influence between science and society go both ways Conceptually this volume presents a situated and reflexive approach for philosophy and sociology of the life sciences The practices that are part of stem cell research are dispersed and the concepts that tie them together are tenuous there are persistent problems with the validation of findings and the ontology of the stem cell is elusive The array of applications shapes a growing bioeconomy that is dependent on patient donations of tissues and embryos consumers and industrial support In this volume it is argued that this research now denotes not a specific field but a flexible web of intersecting practices discourses and agencies To capture significant parts of this complex reality this book presents recent findings from researchers who have studied in depth aspects of this matrix of stem cell research This volume presents state of the art examinations from senior and junior scholars in disciplines from humanities and laboratory research to various social sciences highlighting particular normative and epistemological intersections The book will appeal to scholars as well as wider audiences interested in developments in life science and society interactions The novel matrix approach and the accessible case studies make this an excellent resource for science and society courses

### **The Logic of Social Science**

James Mahoney,2021-08-17 Mahoney s starting point is the problem of essentialism in social science Essentialism the belief that the members of a category possess hidden properties essences that make them members of the category and that endow them with a certain nature is appropriate for scientific categories atoms for instance but not for human ones revolutions for instance Despite this much social science research takes place from within an essentialist orientation those who reject this assumption goes so far in the other direction as to reject the idea of an external reality independent of human beings altogether Mahoney proposes an alternative approach that aspires to bridge this enduring rift in the social sciences between those who take a scientific approach and assume that social science categories correspond to external reality and thus believe that the methods used in the natural sciences are generally appropriate for the social sciences and those who take a constructivist approach and believe that because the categories used to understand the social world are humanly constructed they cannot possibly follow the science of the natural world As the name suggests scientific constructivism brings in aspects of both views and attempts to unite them Drawing from cognitive science it focuses on using the rational parts of our brain machinery to overcome the limitations and deeply seated biases such as essentialism of our evolved minds Specifically Mahoney puts forth a set theoretic analysis that focuses on sets of categories as they exist in the mind that are also subject to the mathematical logic of set theory He spends the first four chapters of the book establishing the foundations and methods

for set theoretic analysis the next four chapters looking and how this analysis fits with the existing tools of social science and the final four chapters focusing on how this approach can be used to study and understand cases

**Chemistry Education and Contributions from History and Philosophy of Science** Mansoor Niaz, 2015-12-23 This book explores the relationship between the content of chemistry education and the history and philosophy of science HPS framework that underlies such education It discusses the need to present an image that reflects how chemistry developed and progresses It proposes that chemistry should be taught the way it is practiced by chemists as a human enterprise at the interface of scientific practice and HPS Finally it sets out to convince teachers to go beyond the traditional classroom practice and explore new teaching strategies The importance of HPS has been recognized for the science curriculum since the middle of the 20th century The need for teaching chemistry within a historical context is not difficult to understand as HPS is not far below the surface in any science classroom A review of the literature shows that the traditional chemistry classroom curricula and textbooks while dealing with concepts such as law theory model explanation hypothesis observation evidence and idealization generally ignore elements of the history and philosophy of science This book proposes that the conceptual understanding of chemistry requires knowledge and understanding of the history and philosophy of science Professor Niaz's book is most welcome coming at a time when there is an urgently felt need to upgrade the teaching of science The book is a huge aid for adding to the usual way presenting science as a series of mere facts also the necessary mandate to show how science is done and how science through its history and philosophy is part of the cultural development of humanity Gerald Holton Mallinckrodt Professor of Physics these are valence bond VB and molecular orbital MO theories He emphasizes the importance of having rival theories and interpretations in science and its advancement He further argues that this VB MO rivalry is still alive and together the two conceptual frames serve as the tool kit for thinking and doing chemistry in creative manners The author surveys chemistry textbooks in the light of the how the books preserve or not the balance between the two theories in describing various chemical phenomena This Talmudic approach of conceptual tension is a universal characteristic of any branch of evolving wisdom As such Mansoor's book would be of great utility for chemistry teachers to examine how can they become more effective teachers by recognizing the importance of conceptual tension Sason Shaik Saeree K and Louis P Fiedler Chair in Chemistry Director The Lise Meitner Minerva Center for Computational Quantum Chemistry The Hebrew University of Jerusalem ISRAEL

Integrating History and Philosophy of Science Seymour Mauskopf, Tad Schmaltz, 2011-09-06 Though the publication of Kuhn's Structure of Scientific Revolutions seemed to herald the advent of a unified study of the history and philosophy of science it is a hard fact that history of science and philosophy of science have increasingly grown apart Recently however there has been a series of workshops on both sides of the Atlantic called HPS intended to bring historians and philosophers of science together to discuss new integrative approaches This is therefore an especially appropriate time to explore the problems with and prospects for integrating history and philosophy of



science The original essays in this volume all from specialists in the history of science or philosophy of science offer such an exploration from a wide variety of perspectives The volume combines general reflections on the current state of history and philosophy of science with studies of the relation between the two disciplines in specific historical and scientific cases

**Spark** Timothy J. Jorgensen, 2023-06-06 A fresh look at electricity and its powerful role in life on Earth When we think of electricity we likely imagine the energy humming inside our home appliances or lighting up our electronic devices or perhaps we envision the lightning streaked clouds of a stormy sky But electricity is more than an external source of power heat or illumination Life at its essence is nothing if not electrical The story of how we came to understand electricity's essential role in all life is rooted in our observations of its influences on the body influences governed by the body's central nervous system Spark explains the science of electricity from this fresh biological perspective Through vivid tales of scientists and individuals from Benjamin Franklin to Elon Musk Timothy Jorgensen shows how our views of electricity and the nervous system evolved in tandem and how progress in one area enabled advancements in the other He explains how these developments have allowed us to understand and replicate the ways electricity enables the body's essential functions of sight hearing touch and movement itself Throughout Jorgensen examines our fascination with electricity and how it can help or harm us He explores a broad range of topics and events including the Nobel Prize winning discoveries of the electron and neuron the history of experimentation involving electricity's effects on the body and recent breakthroughs in the use of electricity to treat disease Filled with gripping adventures in scientific exploration Spark offers an indispensable look at electricity how it works and how it animates our lives from within and without

**Biographies in the History of Physics** Christian Forstner, Mark Walker, 2020-07-22 This book sheds new light on the biographical approach in the history of physics by including the biographies of scientific objects institutions and concepts What is a biography Can biographies also be written for non human subjects like scientific instruments institutions or concepts The respective chapters of this book discuss these controversial questions using examples from the history of physics By approaching biography as metaphor it transcends the boundaries between various perspectives on the history of physics and enriches our grasp of the past

Relativity Principles and Theories from Galileo to Einstein Olivier Darrigol, 2021-12-22 This book is a full long term history of relativity thinking in physics from Galileo's early reflections on the proper reference of mechanical motion to Einstein's exploitation of relativity principles in his theories of special and general relativity

*The Philosophy of Historical Case Studies* Tilman Sauer, Raphael Scholl, 2016-05-24 This volume collects reflections on the role of philosophy in case studies in the history of science Case studies have played a prominent role in recent history and philosophy of science They have been used to illustrate question explore or explicate philosophical points of view Even if not explicitly so historical narratives are always guided by philosophical background assumptions But what happens if different philosophies lead to different narratives of the same historical episodes Can historical case studies decide between competing philosophical viewpoints What are the criteria that

a case study has to fulfill in order to be philosophically relevant Bringing together leading practitioners in the fields of history and philosophy of the physical and the life sciences this volume addresses this methodological problem and proposes ways of rendering explicit philosophical assumptions of historical work     Photons Klaus Hentschel, 2018-08-16 This book focuses on the gradual formation of the concept of light quanta or photons as they have usually been called in English since 1926 The great number of synonyms that have been used by physicists to denote this concept indicates that there are many different mental models of what light quanta are simply finite quantized packages of energy or bullets of light Atoms of light or molecules of light Light corpuscles or quantized waves Singularities of the field or spatially extended structures able to interfere Photons in G N Lewis's sense or as defined by QED i.e. virtual exchange particles transmitting the electromagnetic force The term light quantum made its first appearance in Albert Einstein's 1905 paper on a heuristic point of view to cope with the photoelectric effect and other forms of interaction of light and matter but the mental model associated with it has a rich history both before and after 1905 Some of its semantic layers go as far back as Newton and Kepler some are only fully expressed several decades later while others initially increased in importance then diminished and finally vanished In conjunction with these various terms several mental models of light quanta were developed six of them are explored more closely in this book It discusses two historiographic approaches to the problem of concept formation a the author's own model of conceptual development as a series of semantic accretions and b Mark Turner's model of conceptual blending Both of these models are shown to be useful and should be explored further This is the first historiographically sophisticated history of the fully fledged concept and all of its twelve semantic layers It systematically combines the history of science with the history of terms and a philosophically inspired history of ideas in conjunction with insights from cognitive science

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